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Review on Grey Water, its Components, Constituents, Purpose, Parameters, and Techniques of Recycling

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ABSTRACT

Water resources are polluted by phylogenesis sources including household and agricultural waste and industrial processes. Public gets more responsible over the environmental impact of wastewater pollution. Some wastewater treatment techniques, i.e. chemical coagulation, adsorption, activated sludge, have been applied to remove the pollution, however there are still some limitations, especially that of high operation costs. The use of aerobic waste water treatment as a reductive medium is receiving increased interest due to its low operation and maintenance costs. In addition, it is easy-to-obtain, with good effectiveness and the ability for degrading contaminants. This paper reviews the use of recycling of wastewater and some techniques. This research basically explains the information about the recycling of greywater and use it for domestic purposes, farming, and also for drinking and for landscaping. There are many techniques that recycle wastewater, and use it for many purposes. Those techniques contained huge plants and special zones on the overall site. Basically, this recycling technique is also called a harvest station. It's a recycling machine, which show or place in front or in a gardening area or it is mostly placed in public zones. And also provide seating near the station and also grow planters upon it.

1. INTRODUCTION

This paper presents a literature review based on the technique used for recycling grey water with a filtration tower using the same traditional technique with a new look and purpose. This technique explains how a filtration tower can be used as a landscaping element and also, can provide seating surrounding the tower and the installation of planters near or on the filtration tower. Small-scale projects or public areas do not require the provision of a designated zone for a waste treatment plant. As per the international water management institute of India, water is becoming a rare resource in the world. In day-to-day life wastage of water is increasing. Recycling the water can reduce wastage which is most concerning. There are several methods for recycling wastewater when considering waste of water. Reusing the grey water for drinking, domestic purpose, planting and other. Using some techniques of sustainability we can reduce the power consumption, water wastage, and many others. In this report, the same technique will be

studied in a new way and describe the significance of using harvest stations in households, food courts and other places where water is wasted.

Due to water scarcity, the depletion of natural resources, and global warming, technologies to produce clean water and clean energy have attracted attention on a global scale. Just 28% of the nation's total water supply, or 1123 BCM, is considered to be usable (690 BCM comes from the surface and 433 BCM comes from the ground) [2]. According to Figure 1, irrigation uses account for around 85% (688 BCM) of all water use, and that percentage may rise to 1072 BCM by 2050. Groundwater serves as an important supply for irrigation. The quantity of water consumed by a home or a nation can be referred to as its "water consumption.".

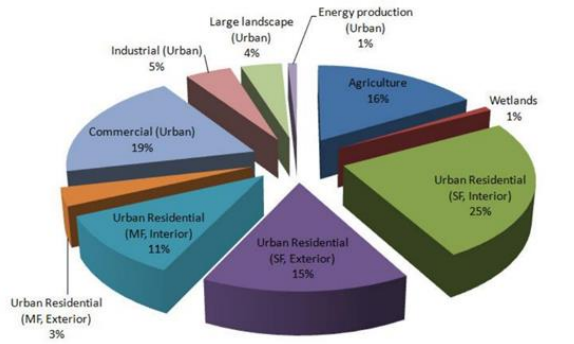

Figure 1: Water Used by Different Sources

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A. What Is Greywater

Greywater is described as wastewater that does not contain any toilet water [3]. It is regarded as high-volume, low-strength wastewater with great potential for reusing and application. According to Abedin and Rakib (2013), do Couto et al. (2013), and Katukiza et al. (2014), the makeup of greywater varies and is dependent on the way of life, fixtures, and meteorological circumstances. Greywater reuse is a historical practice that is currently used in locations with a shortage of water. [4]

B. Greywater Composition

Both potable and non-potable uses, such as toilet flushing and agriculture, can make use of recycled greywater for various water-intensive tasks. The main challenges with greywater reuse have been related to public views of health and the employment of ineffective technology. Greywater properties are also influenced by the type of distribution system and the water supply quality. It is inevitable that the makeup of greywater will vary significantly across time and space. These fluctuations may be caused by changes in how much water is used relative to the amount that is discharged. In the network of transportation and storage, some substances may degrade chemically or biologically, which could have an impact on composition as well.[5]

C. Physical Constituents

Temperature, turbidity, electrical conductivity, and suspended particles are a few of the components that affect how greywater appears on the surface. Greywater typically ranges in temperature from 18 to 35 °C, and the rather high temperature may be a result of warm water used for cooking and personal hygiene. The pH in greywater to a large extent depends on the pH and alkalinity in the water supply and normally is within the range of 5–9 [6].

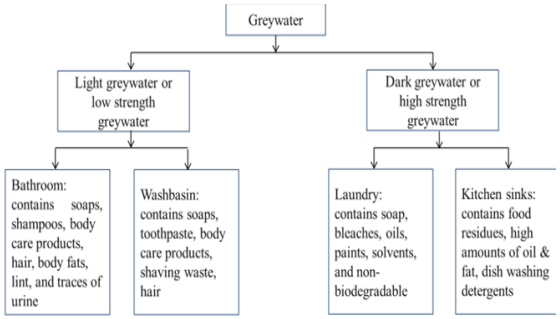

Figure 2: Greywater source and their constituents Reference [7]

1. LITERATURE REVIEW

Greywater reuse techniques are becoming more common in many nations. Some of those nations have assessed their local greywater reuse programmes. Also, they looked into the technological procedures used in reusing and the effects this had on the environment and human health. There are numerous instances of reusing greywater in some parts of the United States, but there are no national laws for doing so because each state is responsible for regulating its own water and sewage systems.

Greywater reuse was discussed in Australia in 1994 and 1997. This study suggests that greywater can be reused. If the conditions are right, this study demonstrates the capability of obviously delivering water, but there is currently no evidence available demonstrating the scope of the reuse of greywater in Australia.[23]

In Japan, greywater is frequently reused. In addition to more elaborate systems utilised in office buildings, it includes modest systems dispersed across households that rely on water from hand washing sinks flowing directly from privately boiling toilet tanks. More than 100 m3 of water is used each day due to Tokyo's requirement

for the reuse of greywater in structures larger than 30,000 m2.

Morel and Diener (2006) discovered that the problem of managing grey water, which includes bathroom, laundry and kitchen wastewater but excludes toilet wastewater, is steadily gaining attention, particularly in low and middle-income countries (LMIC), where insufficient wastewater management negatively affects the environment and public health. The proper reuse of greywater not only lowers the amount of drinking water used by agriculture and water expenses, but also improves public health and boosts food security.

Ayoub and co. (2012) Water A more sustainable supply is made possible by installing decentralised grey water treatment facilities in small rural settlements. A door-to-door study was carried out by interviewers from the Royal Scientific Society in the farming hamlet of DeirAlla, Jordan, to see how residents felt about collecting and using greywater.

Shaikh et al. (2015) showed how greywater from home bathrooms may be treated and reused for irrigation, plant growth, landscaping, and toilet flushing. According to study findings, this treatment technology can be used as a feasible alternative to conventional treatment plants in rural areas because it has a high potential for removing BOD, TDS, TSS, total hardness, oil and grease, anions, and cations.

Kordana (2015), In particular for non-potable uses, suggested that the recycling of grey water and prudent use of rainwater can be a viable alternative supply of water. This research demonstrated that, despite the fact that their implementation is linked to greater investment costs than in the basic scenario, using these systems in the tested building is financially viable (Variant 0).

2. TECHNIQUES USED FOR RECYCLING OF GREYWATER

Basically, there are three types of techniques use for recycling the greywater

A. Physical Greywater Treatment System

As with disinfection and adsorption on activated carbon, these treatment techniques are most frequently utilised in conjunction with other techniques. An easy-to-use, low-cost, and straightforward technology is the sand filter. Other substances, such as activated carbon, are also used in addition to or in place of sand. This greywater treatment system is capable of partially removing organics and particulate pollutants, as well as nitrogen and phosphorus nutrients. [8]

Greywater reuses for irrigation of green spaces often necessitates selecting a sophisticated treatment that enables the production of the effluent of higher grade. As an illustration, greywater recovery methods using membrane filtration have been the subject of extensive research recently. Ramon et al. (2004) [9] contrasted the efficacy of ultrafiltration and nanofiltration membranes in terms of purification. For COD and turbidity, ultra-filtration only achieved 49% and 94% of the decrease, but nano-filtration achieved 93% and 98%.[10]

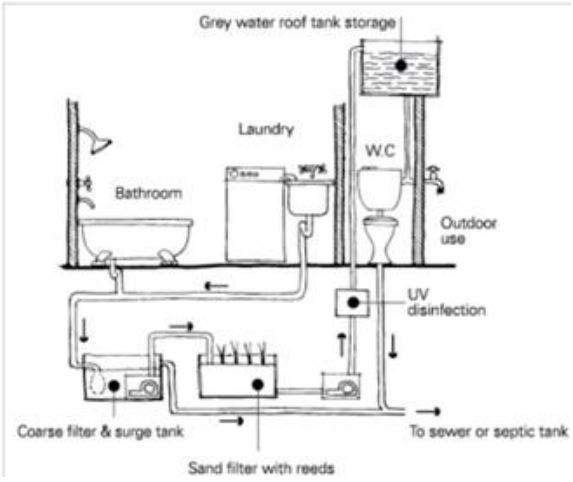

Figure 3: Greywater treatment Resource: Nolde (1999)

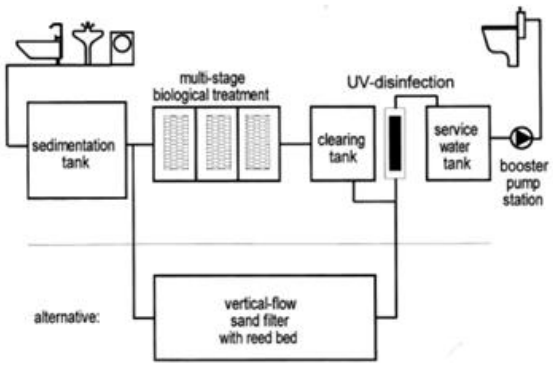

Figure 4: Greywater treatment- component Resource: YourHome, Australian Guidelines for Environmentally Sustainable Homes

http://www.yourhome.gov.au/water/wastewater-reuse

B. Chemical Greywater Treatment System

Coagulation and flocculation, electrocoagulation, adsorption using granular activated carbon (GAC) and natural zeolites, magnetic ion exchange resin (MIEX), powdered activated carbon (PAC), and advanced oxidation processes (AOPs) like ozonation and photocatalysis are among the chemical greywater treatment systems used in greywater treatment (Li et al., 2009; Boyjoo et al., 2013) [11]. Light greywater and, in some situations, laundry

greywater can be used effectively with these systems. When compared to physical procedures, chemical methods can reduce turbidity and organic matter in greywater to some extent, but not enough to meet non potable reuse standards, especially for high strength greywater. [12]

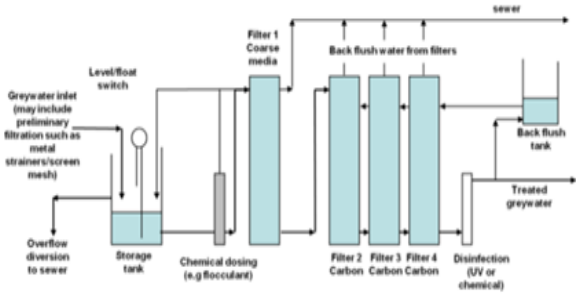

Figure 4: Chemical based greywater treatment technology Source: Toifl et al. (2019)

C. Biological Greywater Treatment System

The most used industrial techniques for treating greywater are biological ones. These processes can function either aerobically, anaerobically, or in a mixed process. Studies that examine the effectiveness of biological processes with suspended and fixed biomass as well as the application of biofilters for the recovery of greywater give varying conclusions. In light of the intricacy of the process and the available space, Otterpohl et al. (1999) [13] suggested using fixed biomass processes as opposed to suspended biomass processes. Additionally, by using a fixed biomass procedure, it is feasible to raise the reactor's overall biomass and thereby enhance the treatment effectiveness.[14]

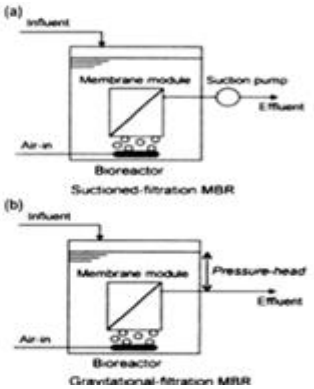

Figure 5: Gravity driven membrane bioreactor (MBR) Resource: Biogill.com

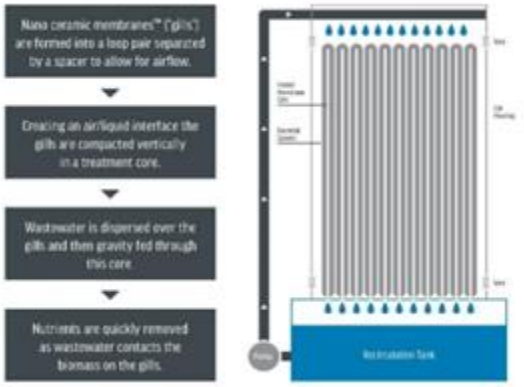

Figure 6: Non submerged synthetic media biofilter Resource: Biogill.com

The biological filter processes have been considered the most environmentally friendly, low-cost, and effective treatments for greywater. The studies from the literature related to the use of biological filters have shown interesting performances, particularly in terms of BOD5, TSS, and turbidity elimination. [15]

Every 5 to 10 years, plant maintenance must be done by cutting and cleaning the plants to get rid of the sludge that has accumulated at the bottom of the lagoon [16]. Additionally, these processes benefit from being seamlessly incorporated into the terrain and help to diversify the fauna and plants.

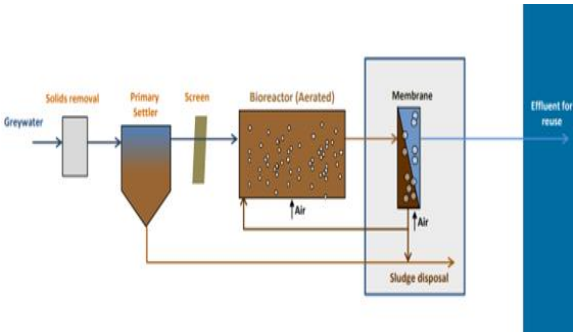

Figure 7: Membrane bioreactor (MBR) Resource: Biogill.com

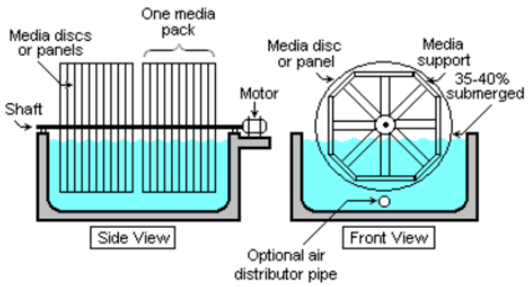

Figure 8: Biological filter Resource: Biogill.com

D. Hybrid System

Other hybrid processes that are regarded as cutting-edge technologies, such as membrane bioreactors alone or in combination with membrane filtration (nanofiltration (NF) or ultrafiltration (UF)) or aerated biofilter processes alone or in combination with filter marshes, have been investigated for greywater recovery. Because the two processes are coupled together, purification on both a physicochemical and a microbiological level is guaranteed, which greatly enhances their overall efficiency. For turbidity, TSS, BOD5, and COD, certain studies revealed significant reductions of over 95%, 75%, 93%, and 85% [17,18,19].The cost of producing treated greywater has significantly increased at the expense of raising its quality through hybrid physical and biological processes.

3. Proposed Greywater Recycling Scheme For Agricultural Irrigation

A. Reuses

A greywater recycling programme for agricultural irrigation reuse purposes was designed based on the analysis of greywater characteristics, guidelines requirements, and greywater treatment technologies that was done above, but without taking the economic viability of the treatment method into account (Figure 1) [20] RBC, SBR, and artificial wetlands are examples of suitable biological processes that can be utilised to remove organic materials from medium- and high-strength greywater. Either of these procedures might be added to the post-treatment membrane filtration, enabling the effluent to satisfy the needs of both restricted and unrestricted agricultural irrigation. Alternatively, sand filtration post-treatment followed by a disinfection step can be applied to meet the requirements of unrestricted and restricted agricultural irrigation. Sand filtration effluent without the disinfection step might meet restricted agricultural irrigation requirements

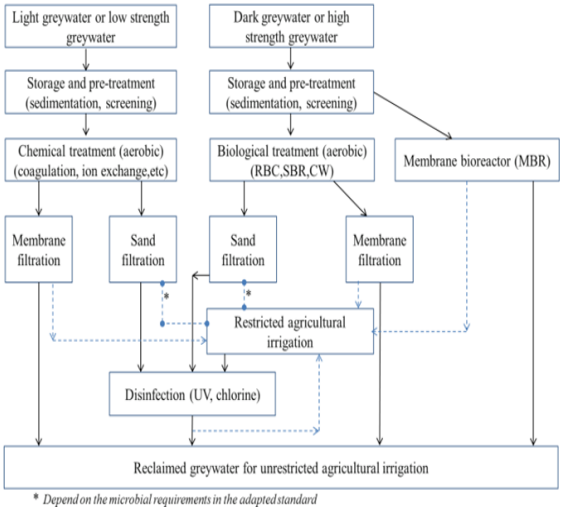

Figure 9 : Possible greywater recycling scheme for agricultural irrigation reuse purposes
Reference :- (Li et al., 2009)

4. Parameters Affecting The Characteristic Of Greywater

The composition of greywater depends on several factors, including sources and installations from where the water is drawn: -

- Quality and type of the water supply (groundwater well or piped water) - type of distribution net for drinking water.
- Type of distribution net for greywater (because of leaching from piping, chemical and biological processes in the biofilm on the piping walls)
- Activities in the household (lifestyle, custom and use of chemical products).
- Installation from which greywater is drawn (kitchen sink, bathroom, hand basin or laundry wash).
- Type of source: household or industrial uses like commercial laundries - geographical location.
- Demographics and level of occupancy - quantity of water used in relation to the discharged amount of substances

5. Biological Characteristics

Greywater is contaminated with microorganisms that are spread by bodily contact, including bacteria, protozoa, and helminths. Enteric pathogenic bacteria, including Salmonella and Campylobacter, have been shown to enter greywater through improper food handling in the kitchen and direct handling of contaminated food [21]

Greywater is frequently contaminated with faeces, which is mostly brought on by poor personal hygiene and the disposal of this washed-napkin-containing water.

6. ENVIRONMENT AND HEALTH RISKS RELATED TO GREYWATER REUSE

Reusing greywater that has not been treated is fraught with issues. If the water is to be reused for things like irrigation or flushing toilets, the danger of disease developing owing to exposure to microorganisms in the water will be critical. Hand-to-mouth contact and breathing (aerosols) can both be risky. Microorganisms and various chemicals can also come from system growth. [22] The quality of the greywater that will be recycled must also be acceptable. The distribution system may get clogged by suspended solids. Sulphide formation, which occurs when oxygen levels fall and produces an unpleasant odour, is another issue.

7. NEED

In day to day life craze of food is being increasing, but there's no hygiene over the place and wastage of food, water is increasing. Recycling the food and water can reduce the wastage which is most concern, and as per health concern, thinking of wastage of water rain water harvesting is required. Reusing the grey water from the kitchen for planting. using some techniques of sustainability we can reduce the power consumption, water wastage and many others. This report can bring another way of thinking and using stations in households too. As there is no technique showing seating around the filtration tower.

CONCLUSION

- All the water filtration methods and plants are big in size and have to place in special zone, there is no method or filtration plant which include seating and plantation around that tower
- From this research we are going to introduce the same techniques but different looks for the tower/ filtration plant.
- This tower / filtration plant is also used as landscaping purpose.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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